University of California
Lawrence Livermore National Laboratory
Energy Directorate

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Livermore's energy technologies benefit the U.S. economy, the environment, and national security

Mission

In the Energy Directorate, we draw on Livermore's multidisciplinary strengths to develop energy technologies that enhance national security, are economically feasible and safe, and have minimal environmental impact. We work with industry to ensure commercialization of these technologies. We support U.S. policy makers with data in the energy arena, and we address energy issues that are beyond the resources of industry.

Worldwide Challenges

Attaining long-term, ecological, and economic solutions to meet the world's need for energy demands excellent science and requires the best efforts of multiple scientific and political institutions. Energy use, transportation, manufacturing, and waste handling are interrelated challenges requiring integrated solutions. In our research, we collaborate with other national laboratories and government agencies, U.S. industry, universities, and international partners to meet these challenges.

Our energy work capitalizes on Livermore's hallmark capability to develop novel scientific concepts and transform them into working prototypes to solve real-world problems. Many weapons-program technologies have found spinoff applications in the energy arena.

Energy Programs

Four programs comprise the Energy Directorate:

- **Magnetic Fusion Energy:** Livermore is a strong player in the international effort to develop a magnetic fusion reactor as a source of electric power for the 21st century. We are also exploring alternative concepts for fusion reactors to reduce size, complexity, and cost.
- **Fission Energy and Systems Safety:** Livermore's multidisciplinary engineering and scientific strengths are applied to resolve technical issues that inhibit public acceptance of nuclear power, including safety, life-cycle management of nuclear materials, and nuclear proliferation.
- **Energy, Manufacturing, and Transportation Technologies:** Livermore technologies are being adapted to applications in energy, manufacturing, materials, and transportation. For example, we are helping to develop an automotive power system that meets established future performance requirements, including issues of fuel supply, emissions, materials, economics, safety, and manufacturability.
- **Energy Analysis, Policy, and Planning:** Consonant with Congressional and Administration direction, we do long-range planning regarding Livermore's energy work and identify new research directions.

Recent Accomplishments

- Formulation of concepts for advanced tokamaks, including the Tokamak Physics Experiment (TPX), to lower the anticipated cost of fusion-generated electricity.
- Remote operation of fusion facilities via the Internet and development of distributed computing architecture for sharing experimental data in real time. This process was demonstrated recently when the tokamak at the Massachusetts Institute of Technology was operated from a Livermore control room.
- Significant responsibility for engineering design and R&D for the International Thermonuclear Experimental Reactor.
- Provision of personnel for on-site inspection teams, as called for in the highly enriched uranium transparency agreement between the U.S. and the former Soviet Union.
- Development of a concept that would keep nuclear waste packages at the proposed Yucca Mountain repository dry for 5000 years, thus ensuring substantially complete containment.
- Technology development for the use of hydrogen as a transportation fuel, including the concept for a mechanical equivalent of the fuel cell that can be used to power a hybrid vehicle.
- Development of a flywheel battery that can be used for stationery storage and power conditioning and for transportation.
- Development and refinement of superplastic steel and aluminum alloys suitable for near-net-shape processing to minimize waste.
- Fabrication of two mirrors for the Keck telescope in Hawaii, using Livermore's Large Optics Diamond Turning Machine.

Benefits to the Nation

Energy is the driver for all economies and is essential for national security; however, energy production and energy use account for much of the world's pollution. Livermore is striving to become a leader in industrial ecology as we apply our multiprogram, multidisciplinary approach to solving complex problems and developing a broad range of integrated technologies—from fusion to flywheel batteries—to help the nation make better use of all of its energy resources. These technologies focus on sustainable energy use and on meeting the long-term strategic needs of the nation. These technologies should also provide the U.S. with opportunities for marketing to developing nations, where energy use is rapidly increasing.

Contact

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